Civil Defense

PROJECT HARBOR SUMMARY REPORT

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CIVIL DEFENSE

Project Harbor Summary Report

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at

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During the winter of 1962-63 the Assistant Secretary of Defense for Civil Defense requested the National Academy of Sciences to organize a summer study in the field of civil defense. The study, known as Project Harbor, was under the Directorship of Dr. Eugene P. Wigner and the Deputy Directorship of Dr. Lauriston S. Taylor, Chairman of the Academy's Advisory Committee on Civil Defense. It was carried out at the Academy's study center at Woods Hole.

The accompanying report represents a condensed version of the approximately 1,000-page report of the study group.

The list of those who participated in the study is on page 28 of the report.

FREDERICK SEITZ
President

Foreword

It is difficult to report on a group effort such as the Harbor Study because the change in attitudes and intuitive convictions acquired by the members in the course of the study are at least as important a result as the technical conclusions. For many participants, the most striking experience was the ease with which contacts between members with different backgrounds and interests were established and how the appreciation of relevant problems – physical, technical, economic, societal and even emotional – grew in members of the group. This experience is good augury for the success of a concerted effort undertaken jointly by specialists in many fields.

On the other side of the picture is the fact that Harbor has introduced few entirely new ideas and uncovered no panaceas. The promise of coupling anti-ballistic missile systems with passive defense was increasingly realized. This coupling would make the task of the former easier and the measures of the latter more effective as far as the preservation of lives is concerned. Perhaps less striking but probably more important were the general conclusions, some of which follow.

The most significant change in the threat of the foreseeable future is expected to come from more numerous, more efficient, and more powerful nuclear weapons rather than from weapons of essentially new types. Thus, a civil defense system could be instituted now which would not be rendered ineffective by changes in the nature of offensive weapons of the foreseeable future.

Nuclear war would result in great loss of life, great devastation, and great misery. But appropriate protective measures which are well within the economic means of the nation could drastically reduce the number of casualties. Even without such protective

measures, situations in which all life on earth would be destroyed can in the foreseeable future occur only in fiction.

The preservation of the economic wealth of the nation is a more difficult task, and perhaps also more costly, than the preservation of lives. It would take many years after a nuclear war to make all the commodities that we now take for granted generally available. On the other hand, if some elementary and relatively inexpensive measures are taken ahead of time, no famine need result and there would be no crippling shortage in the other immediate necessities of life.

The management and operation of a civil defense program of reasonable size and effectiveness might require a federal cadre of about 30,000 professional people, cooperating closely with local authorities and using local capabilities. It was one of the conclusions of the project that a civil defense program along the lines described in the project reports and this summary would not seriously interfere with the normal functioning of our institutions nor of our democratic society. It would create no serious problems of acceptance or impact, at home or abroad. In the opinion of many, it would reduce tension and would further constructive thinking.

I wish to express thanks to all who participated in the Harbor Study, and to the government agencies that provided information and administrative assistance. Although representatives of these agencies participated directly in the study, the conclusions and recommendations of the Project Harbor reports do not necessarily reflect the official position of these agencies.

EUGENE P. WIGNER
Director

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Introduction

ESTABLISHMENT OF PROJECT HARBOR

In early 1963, the Assistant Secretary of Defense (Civil Defense) requested that the National Academy of Sciences arrange for a study of civil defense problems. Pursuant to this request, the Academy invited a group numbering over 60 and consisting mainly of scientists and engineers, from universities, private industry, and government organizations, to participate in a six-week meeting beginning August 5, 1963, at the Academy's summer-study facility at Woods Hole, Massachusetts. The group was requested to examine the likely effects of various kinds of attacks on the United States, and the present and future problems of civil defense of the country. The technologies of passive (civil) defense were considered both independently of active (military) defense systems such as anti-ballistic missile systems, and, as far as time permitted, in conjunction with them. The study group was divided into six panels: Acceptance and Impact; Education and Training; Strategy and Tactics; Future Weapons and Weapon Effects; Immediate Survival; Postattack Recovery.

ORGANIZATION

The study, known as Project Harbor, was under the leadership of Eugene P. Wigner, Princeton University. He was assisted by an executive committee consisting of Lauriston S. Taylor, National Bureau of Standards, who was Deputy Director; Jack A. Vernon, Princeton University; John S. Coleman and Richard Park of the National Academy of Sciences staff; L. Joseph Deal, Atomic Energy Commission; and Jack C. Greene, Office of Civil Defense.

BRIEFINGS

The first week of the study was devoted to a series of briefings concerning the technical factors that influence civil defense. Thus, the Defense Atomic Support Agency described nuclear weapons and their effects, the Air Force's Warfare Systems School discussed U. S. military capabilities in air defense and in offensive weapon systems, the Defense Department's Defense Intelligence Agency described the offensive and defensive weapon systems of the USSR, and Leon Gouré of the RAND Corporation summarized his conclusions on the USSR civil defense system.

The results of various studies of hypothetical attacks on the United States were presented by the Office of Civil Defense, the National Military Command Systems Support Center, the Weapons System Evaluation Group, and the National Resources Evaluation Center. The Atomic Energy Commission provided briefings on the biological effects of nuclear weapons, in particular on blast biology, radiobiology, damage from thermal radiation, and long-term effects of nuclear radiation. The Office of Civil Defense and the Office of Emergency Planning discussed their plans and programs.

The week of briefings ended with consideration of possible future weapon systems. The development trends for nuclear weapons were discussed by Edward Teller and Carson Mark, and the problems of the anti-ballistic missile systems by representatives of the Institute for Defense Analyses.

The formal briefings were supplemented by informal lectures by Herman Kahn and Edward Stillman of the Hudson Institute on their projections of the international situation into the 1970's.

Participants, briefers, consultants, and observers are listed in Appendix A.

REPORTS

Each of the six Project Harbor panels prepared a report in its assigned area. These reports constitute the major output of Project Harbor; they are transmitted to the Office of Civil Defense with only minor editing revisions.

In response to a request of the Office of Civil Defense, some of the conclusions of the Harbor Study were summarized in a very brief report (reproduced here as Appendix B) submitted to that

agency in February, 1964, by the president of the National Academy of Sciences. The present more extended summary gives more detail than the report just mentioned. It is, essentially, an integrated composite of the summaries of the six panel reports, and may be considered as an introduction to them.

There was a clear consensus of the study participants concerning such major questions as the technical feasibility of achieving civil defense protection and capability for recovery which is much greater than that so far contemplated. A few points of disagreement remained, however, in the panel conclusions. In the present report, the Executive Committee of Project Harbor has attempted in some degree to resolve these.

PANEL SUMMARIES

Summaries of the reports of the six panels are presented in the following pages.

Acceptance and Impact

ASSIGNMENT OF THE PANEL

The objectives of the panel were to explore the basis for attitudes on civil defense, and to consider the reasons for objections and whether and how they could be met.

CONCLUSIONS ON ACCEPTANCE

Acceptance of military programs, including those for civil defense, depends on the view that there exist national and personal values that are worth fighting for and preserving at any cost. This view leads to the support of a national policy and program of civil defense, and to the realization that it is a social as well as personal responsibility of each individual to make every effort for survival.

If civil defense is to be recognized as a valid means of discharging this responsibility, its unequivocal acceptance by the President, the National Security Council, the Joint Chiefs of Staff, and the Congress is necessary. The more vigorously these individuals and groups exercise their leadership and set examples, the more favorable will be public attitudes toward the program, and the more willing responsible governing bodies will be to contribute to it.

Public attitude will be influenced also by the character of the program. The acceptability of programs is enhanced if they have the following characteristics:

1. The federal government accepts full responsibility for them, as parts of total national defense, provides initiative, and sets an example for state and local administrative units.

2. The leadership of the program has strong, specific support from the armed forces, clearly linking the program to the total defense of the nation.

3. They are conducted by professional, technically qualified personnel.

4. They make maximum use of the available capabilities of communities, such as fire and police protection, and do not overlap and compete with these.

5. They do not involve the general public except when clearly necessary for effectiveness of the program, or when there is popular demand to do so.

6. The rate of growth is not so steeply accelerated as to take the form of a crash program.

7. They are large enough in total effort to appear sufficient to meet anticipated requirements, rather than so small as to appear patently inadequate. On the other hand, massive programs, particularly if steeply accelerated or crash-type, would be acceptable only if international relations severely deteriorated.

8. Their objective is equitable protection for all Americans, and they have a high legacy value in relation to subsequent program changes.

9. They lead to dual use of facilities and organizations; for example, the use of shelters as garages and for storage or recreational purposes, and the use of civil defense forces to help in floods and other natural disasters.

10. They contribute to the reduction of anxieties and tensions by being coupled with other efforts of the government to assure national survival.

11. The federal government provides continuing, candid, and reliable information.

CONCLUSIONS ON IMPACT

Programs with the above characteristics not only would be acceptable, but also would tend to minimize the possible detrimental effects—psychological, social, economic, domestic, political, and international. It is extremely difficult, of course, to prove that no harmful effects whatever will accrue from any major activity. But

charges that programs of the type described above will change the nature of our society, or lead to a garrison state, or alter American values beyond recognition, or produce widespread anxiety, are entirely unsupported by the evidence. Similar charges have accompanied all major national programs in the past, whether it was the adoption of federal income tax, New Deal legislation, universal military training, or the civil defense measures undertaken so far. If executed in a reasonable manner, the impact of a civil defense program on the spirit of our community and the vigor of our institutions will be favorable.

In those foreign countries, such as Sweden, where a significant effort toward an effective civil defense posture has been made, there has been no evidence of deleterious impact, either internal or external. Furthermore, serious acceptance problems have not been encountered.

Education and Training

ASSIGNMENT OF THE PANEL

The objective of the panel was to examine the problems of (a) education of civil defense officials, (b) keeping the national and local leadership informed of the problems and status of civil defense, and (c) educating and training the public in consonance with the civil defense programs discussed and described by the other panels.

CONCLUSIONS

Clearly, a vigorous program of education and training must be an integral part of any civil defense effort, large or small. The Education and Training Panel of Project Harbor suggests a program consisting of five parts:

1. *Training of Technical Personnel*

Short courses and training programs could give those in technical professions special knowledge concerning thermonuclear war and problems of protecting and recovering from it.

2. *Informing the General Public*

The principal means would be through

a. *adult education,* including general orientation and self-help courses, offered by qualified institutions;

b. *job-connected orientation,* introduced through employers, unions, etc.;

c. *general information* disseminated by the mass communications media; and

d. *secondary-school education* by introduction of material into secondary-school curricula.

3. *Training an Operating Organization: the Professional Civil Defense Cadre**

Adequate education and training of such a cadre will require

a. establishment of a preparatory training and orientation program for recruits to the cadre;

b. establishment of a command school to prepare cadre personnel for advancement and command responsibility; and

c. establishment, within such a command school, of a planning section to contribute to the development of general policies and procedures for the civil defense establishment.

4. *Training a Civilian Reserve Corps*

To be economically acceptable, a professional cadre would have to be small – too small to be able to man all the positions of an adequate civil defense organization. An additional organization, to be called a civilian reserve corps, is needed to provide additional manpower that would be necessary in an emergency. Its training should

a. provide corps personnel with the knowledge of the functions expected of them. These functions would form part of the procedures of the entire civil defense organization.

b. establish familiarity with shelter facilities and their use; and

c. enable corps members to teach shelter occupants basic nuclear hygiene and instruct them concerning postattack recovery plans and procedures.

5. *Establishing a National Civil Defense Research Center*

The research center is viewed as a key element in the total education and training program, as well as in the research effort. In addition to integrating the total national effort in education and training, and in research, it would provide impetus toward improved approaches to old problems, and would evaluate available solutions.

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* See also the Immediate Survival Summary.

Strategy and Tactics

ASSIGNMENT OF THE PANEL

The Strategy and Tactics Panel was assigned the task of describing the circumstances surrounding the outbreak of a nuclear war, the probable course of events during hostilities, and the circumstances leading to their cessation, and thus to provide the other panels with visualizations that would be useful to them in carrying out their assignments. The panel also examined a number of studies and calculations on the degrees of civil defense protection achievable at various costs under a range of probable attacks. These calculations served as an orientation for Project Harbor throughout the study.

SUMMARY

Because the Strategy and Tactics Panel's assignment was primarily to provide the other panels with useful visualizations rather than to reach conclusions, its report is quite different from those of other panels. The present summary is thus limited to a discussion of three types of attack situations considered by the panel. These are designated as Alpha, Beta, and Gamma.

Alpha. The most extreme situations, the Alpha types, relate to attempts to annihilate the United States in a surprise attack "out of the blue". According to one Alpha situation, the enemy secretly procures enormous numbers of unhardened missiles capable of carrying very-large-yield warheads. The enemy picks a time for, and launches, an optimized salvo at the 200-300 largest cities, together with a supplementary attack on rural areas and on our retaliatory capacity. The force directed at our retaliatory capa-

bility is inadequate to neutralize it, and thus both sides suffer extremely heavy damage. Such pre-planned, all-out, secret attempts at destroying the United States are considered implausible by the panel because (1) the enemy would not be willing to accept the high risk of being himself destroyed by the undamaged portion of our retaliatory forces; (2) an enemy would not wish to spend funds on such vulnerable and provocative weapons; (3) the prolonged, absolute secrecy required would be too difficult to maintain.

Situations of the Alpha type are not very likely, but cannot be completely excluded from consideration.

Beta. Beta types assume that the enemy makes the destruction of our retaliatory capability the major objective, either with attack on U. S. population a secondary mission, or with the threat of such an attack used as a blackmail ultimatum. If the enemy attacks the population, he must be prepared for retaliation in kind with an effectiveness that would depend on the success of the attack on our retaliatory forces. If, however, the enemy in his first attack avoids hitting civilians, our response would quite likely be against military rather than civilian targets, and would be followed by bargaining.

Thus the type of Beta attack in which civilian casualties are avoided might appear, in the eyes of the enemy, to be safer and lead to more satisfactory results. It therefore seems the most likely of the Beta types.

Gamma. In Gamma situations, a crisis erupts into general thermonuclear war only after many intermediate steps that might take weeks or months. The opening crisis could take place in any one of several local conflict situations. The possible intermediate steps include violence, official protests, armed intervention, ultimata, evacuation, exchange of notes, military demonstrations, nuclear demonstrations, armistice, armistice violation, and many others. At almost any point, the tension could relax, and the imminence of general nuclear war recede. On the other hand, in crises the possibilities of inadvertent war increase.

Gamma types have higher probability than the others.

ASSESSMENTS

1. General nuclear war is unlikely to occur except after a build-up of tensions — possibly even after limited military action — that would provide days to months of strategic warning.

2. If this view is correct, the warning problem would be eased, and crisis actions, such as strategic evacuation and improvised shelter construction, would be made possible. Planning that would render such crisis actions effective should be carried out as soon as possible.

Future Weapons and Weapons Effects

ASSIGNMENT OF THE PANEL

The panel assignment was to review the possible directions in which the development of future weapons may lead in order to determine the range of threats that should be considered.

CONCLUSIONS

While it is obviously impossible to foresee future weapons systems accurately, it is believed to be most unlikely that the general features of a civil defense system designed to protect against nuclear attack with present weapons would be invalidated in the foreseeable future. The panel conclusions follow:

1. Nuclear weapons appear to be the most serious threat to our lives in the event of a major attack on the United States.
2. Nuclear weapons will become more efficient, i.e., will have a higher yield per unit weight. Their total yield will probably also increase. However, their effects will not change in nature.
3. New attitudes about appropriate targets are likely to develop as the number of nuclear weapons available to an attacker grows.
4. The fire effects even from the largest weapons would not gravely complicate the design and development of an effective shelter system.
5. Very large-yield explosions deep in the ocean can cause damaging tidal waves along extensive coastal shores, but the

expected damage and loss of life would be very much smaller than those to be expected from explosions of the same magnitude in close proximity to the harbors or cities under attack.

6. Biological agents pose a lesser threat than nuclear weapons to the civilian populace because their delivery involves extremely difficult logistics problems and their effectiveness will always be subject to large uncertainties introduced by weather and possible countermeasures.

7. Chemical warfare is even less likely to be of major influence on civil defense, since chemical agents are less effective in producing casualties than biological agents and far less effective, per pound of weapon, than nuclear weapons.

8. The so-called neutron bomb, if it could be produced, poses no real strategic threat to cities.

9. Enhancing fallout by creating special radioactive isotopes necessarily reduces the blast and thermal yields for the same bomb weight. More importantly, although their use can provide a small increase in dose rate for a useful length of time, they would not provide any increase in total fallout dose.

10. Only under conditions of weather, season, and geography that are favorable to the occurrence of large-scale fires in peacetime will nuclear detonations produce large-scale wildlands fires. Large forest fires are possible but it is not reasonable to fear that all our woodland could be denuded; this is because weather conditions favorable to fire-spread do not occur simultaneously over all parts of the country.

11. Fires in communities constitute a serious menace that deserves attention. It should be noted, however, that, except for short spurts, fire-spread is generally slow, averaging about one tenth of a mile per hour, and seldom travels farther than five or ten miles in any direction even in areas of plentiful combustibles. In many suburban areas and in most rural areas, fire will not spread significantly and damage is likely to be limited to isolated fires from individual ignitions. Spread of fire is less sensitive to weather conditions in urban and suburban areas, however, than in wild lands.

12. Even in mass fires, the fraction of casualties among the population is generally small. However, casualties may rise seriously when blast damage accompanies and aggravates the

fire problem. Many persons trapped in or under collapsed buildings could become fire casualties, and persons driven from shelters that do not provide fire protection could become fallout casualties.

13. The number of fires induced by thermal radiation can be significantly reduced by simple precautionary measures prior to attack: clearing or covering of rubbish, removal of flammable curtains, or shuttering windows with reflective shades or aluminum foil. Such measures would be less effective in regions of appreciable blast.

14. Firefighting in areas where thermal ignitions have occurred can be most effective in the first few minutes after exposure. Even in the absence of blast or immediate fallout, no prompt help can be expected from normal fire departments. The large number of small fires that are most likely can best be controlled by people on the spot if they have some understanding of the situation, and by the mobile units to be discussed in the next section.

15. The increasing extent of blast damage, including damage to recovery capability, to be anticipated in the event of attacks against cities in future years points to the need for blast protection in conjunction with fallout and fire protection.

Immediate Survival

ASSIGNMENT OF THE PANEL

The assignment of the Panel on Immediate Survival was examination of the problems of protecting the populace during nuclear attacks and of ensuring their survival for a period of about two weeks following the last attack. The problems of warning, shelter construction, supplying the essentials of life, communications and control, morale, and preparation for recovery were included in the assignment.

SUMMARY

The panel concentrated its efforts on formulating principles of a civil defense system, on visualizing how it would function, and on indicating the steps whereby civil defense capabilities might be improved.

Principles of a civil defense system. Principles advocated by the Immediate Survival Panel that deal with federal responsibility, professionalism, the dual- or multi-purpose nature of the installations, equity in protection, use of local capabilities, and the desirability of a continuous, steady buildup have already been mentioned in the conclusions of the Acceptance and Impact Panel. These principles were proposed by both panels. The Immediate Survival Panel advocates their adoption, and adoption of the following additional principles:

1. A unified command structure is the most effective way to meet the requirements of warning, evacuation, sharing of resources, and similar functions.

2. Civil defense planning should be carried out so that preparations fit local situations. At the same time it should be compatible with enlightened peacetime planning and organization.

3. The planning of civil defense measures should go hand in hand with the planning of active defense measures, particularly of the anti-ballistic missile system.

4. The protection of the population should be applicable to a variety of threats, cover the spectrum of probable attack sizes, and provide roughly equal chance of surviving fire, blast, or radiation.*

5. The system should not only be effective when it is completed but also provide increasing protection while it is being established.

6. Planning, organization, and training in advance are essential even for crisis programs. (See also the Strategy and Tactics summary.)

Cadre of civil defenders. To put these principles into practice, a professional organization, identified in earlier sections as a cadre of civil defenders, would be needed. In size, such a cadre might approximate the Coast Guard or the Public Health Service, i.e., have about 30,000 full-time employees. In carrying out its duties of planning, organizing, and particularly of operating a civil defense system, supplementary help from the civilian reserve, also mentioned previously, would be required.

Physical preparations. In conformity with the preceding principles, physical preparations would be planned and supervised by the cadre of civil defenders, assisted by local representatives so that the general plan would be adapted to local conditions and circumstances.

The main element of physical preparations is the equipped shelter. Four general classes of such shelters can be distinguished. Class I provides protection against an overpressure of 100+ psi and has a radiation-protection factor** (PF) of 10,000 or more.

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* Note that this principle differs from the one in the summary of the Panel on Acceptance and Impact which calls for providing the population with protection that corresponds in degree of effectiveness with the anticipated degree of danger.

** This term expresses the relative reduction in the amount of radiation that would be received by a person in a protected location compared to the amount he would receive if he were not protected.

It also protects against fire and permits escape even if covered by hot rubble. Class IV corresponds to the present fallout shelters, which have a minimum PF of 40, the average being about 200. They have no specific provision for blast or fire resistance but do not increase the danger from these hazards. Shelters of Classes II and III are between these in degree of protection both against radiation and against heat and blast.

The present fallout-shelter system could be made more effective by adopting ten further measures:

1. Extension of the program to residential, non-urban areas to accommodate the population at night as well as in daytime.
2. Survey of existing shelters to locate those that can be easily converted to Class III. They provide a protection factor (PF) 100 against radiation, protect against an overpressure of 10 psi, and provide fire refuge for a few hours.
3. More complete provisioning of the shelters and establishing of storage depots for food and medical supplies all over the country.
4. Regulations for the incorporation of shelters into new buildings as they are constructed. (In Denmark, Finland, the Netherlands, Norway, Sweden, and Switzerland, shelters are obligatory in new buildings designed for occupancy by more than one family.)
5. Construction of new, Class II and Class I, single- and dual-purpose shelters.
6. Establishment of dispersal centers in the vicinity of cities to serve also as headquarters for civil defense personnel.
7. Construction of shelters and other facilities for utility personnel to permit manning and rapid repair of utilities. This measure is actually designed to facilitate postattack recovery.
8. Organization of mobile units, equipped with shielded vehicles, to maintain order outside the shelters, to engage in minor firefighting, to help in evacuating people where this is most urgent, and also to inform the sheltered population of events outside, in particular the radiation level.
9. Encouragement of private construction of shelters. (Several large enterprises have already taken steps in this direction.)
10. Provision of protection for farm animals.

Few of these measures are new, but all would increase the effectiveness of the present system.

The following table gives estimates of the cost of a single shelter space (for a single person, ten square feet) in mass-produced shelters. This cost depends, naturally, on the size of the shelter and its effectiveness. It does not include the cost of the space that the shelter would occupy or of eliminating possible interference with utilities. On the other hand, neither does it take credit for other possible use nor does it assume the utilization of tunnels, underground passages, and similar facilities.

ESTIMATED COST OF SHELTER SPACE*

Size of shelter	*Class I 100 psi, 10,000 PF*	*Class II 50 psi, 200 PF*	*Class III 10 psi, 100 PF*
100 space	$300/space	$250/space	$200/space
1000 space	$175/space	$140/space	$110/space

Five functions of civil defense. To cope with problems during and immediately following the attack period, and to make effective use of the preparations, civil defense will have to perform five principal functions. All of them rely not only on the physical preparations but also on highly competent and, in some cases, specialized personnel. The five functions are: (1) command, (2) warning and communications, (3) firefighting, rescue, police, damage assessment, repair, decontamination, (4) medical and personal care, resource allocation, and (5) repair and maintenance of shelters and of other equipment, particularly of mobile units.

The cadre of civil defenders must be ready and able to carry out all these functions and must be equipped for them. This implies considerable operating expenditures and the maintenance of high morale and esprit de corps. Continued improvement of physical and educational preparations would contribute to these requisites.

Proposal for a prototype system. The need for data on requirements, as well as for an operational doctrine for operating a civil defense system, leads to the requirement that a complete prototype system, including shelters, sector staff, and district staff, be con-

* OCD estimates that the *incremental* cost of putting 100-PF fallout shelters in new construction, such as is called for in the proposed shelter development program that went before Congress in 1963, would be 40 dollars per space.

structed. Our country has no personnel experienced in the operation of a complete civil defense system.

In the absence of even a prototype of a coherent system, the results of computer studies of highly idealized, model shelter programs can be accepted, at best, only with reservations. The panel deplored a tendency to equate "model shelter programs" with an operational civil defense system.

Time-phasing. Achievement of the desired civil defense system is handicapped by legal, social, political, and budgetary restrictions. The changes can be described in three time periods: transition, build-up, and maintenance.

The prototype system, representing urban, non-urban, and near-target situations, should be selected and staffed. Shelters and headquarters should be built, utilities hardened, and other construction activities of the prototype system should be undertaken on a small but realistic basis.

For the transition stage, the relation between federal and state responsibility needs re-examination. The Civil Defense Act of 1950 does not fully remove confusion concerning responsibility. The clear specification of authority and responsibility has been represented as one of the bases for the success of the civil defense effort in Sweden.

ADDITIONAL INFORMATION ON TOTAL SHELTER SYSTEMS

(The following statement was prepared after the report of the Immediate Survival Panel was written, and has not been examined by that panel.)

Various shelter postures are possible, beginning with the present, fallout-shelter-only posture. The marking, provisioning, and other preparation of these shelters could be accomplished at the present rather modest level of expenditure. Far toward the opposite end of the spectrum of possible postures would be a system which could accommodate the inhabitants of all cities with a population in excess of 250,000. All together, 75,000,000 people live in such cities, and the cost of providing Class I (100 psi, 10,000 PF, fireproof) shelters for them may be $20 billion. Recent studies indicate that such shelters, together with fallout shelters for the remaining population, could protect the lives of 80 per cent of the

U.S. population against an anti-population attack of 3,000 MT, provided that the warning is received in time for the population to reach the shelters.

In considering the relation of civil defense to the anti-ballistic missile system, it should be noted that a Class I shelter protects its occupants against the blast from a 1 MT weapon exploded at least 5,000 feet above ground level; for a 10 MT weapon, the corresponding altitude would be 11,000 feet, and, for a 100 MT weapon, 23,000 feet. It seems evident that it would be easier and less expensive to establish an anti-ballistic missile defense which could intercept at a height of about 15,000 feet than one that had to intercept the missiles before they enter the atmosphere. Such an active defense system would afford protection of shelter occupants against the weapons now available. The possibility that a combination of active and passive defense might eventually provide protection for a very large fraction of the population, even against extreme forms of attack, emphasizes the need of close coordination of civil defense planning and the planning of active defense. It should be noted, however, that an active defense of the kind envisaged would not prevent explosions at higher altitudes, which, though not affecting shelter occupants, could be highly destructive to buildings and facilities.

The possibility of an effective combination of active and passive defense should not obscure the fact that civil defense is effective by itself.

Postattack Recovery

ASSIGNMENT OF THE PANEL

The Postattack Recovery Panel was principally concerned with the period after the cessation of hostilities and with the situation in which the radioactivity has decayed sufficiently so that people could emerge from shelters for extended periods. The problems then would be to provide people with the immediate necessities of life, to inform them of the state of their surroundings and, with minimum delay, to start the work of reconstruction and the restoration of social, economic, and governmental structures.

SUMMARY

In the consideration of postattack recovery problems, one general theme appears to predominate throughout: additional or continuing research is needed to define postattack problems in quantitative terms and to evaluate the relative effectiveness of proposed measures to alleviate postattack situations.

The Recovery Panel proposes three types of measures. The measures of the first type would go hand in hand with those proposed by the Immediate Survival Panel and would aim at a reduction of the damage to our resources, such as food stocks and water and power sources. The second type of measures deals with the distribution and management of supplies and would help to sustain the population during the period of great scarcity that would necessarily follow a nuclear war. The third type of measures would aim at a restoration of the productive facilities and of societal and governmental structures. There is, evidently, some conflict between the last two objectives. Thus, in the economic area, the demand

for commodities necessary for daily living would have to be weighed against demands for capital investment for rebuilding the economy. In other postattack problem areas, there would have to be reconciliation of the need for protecting people from radiation exposure with the demand for making an early beginning of postattack countermeasures, such as decontamination.

It should be noted that considerations leading to the conclusions on economic recovery were based on the assumption that the attack lasts only a few days, and thus that the period for clean-up and reconstruction is neither delayed nor interrupted by a renewed outbreak of hostilities.

A factor favoring recovery capability is the great size of our resources, in particular of our food stocks and production facilities. Unfavorable factors are the current vulnerability of these facilities, their concentration in or near large cities, and their dependence on each other so that destruction of one facility may paralyze many others. Also unfavorable are the inadequacies of plans for postattack recovery. The postattack situation, when compared with the problems of an underdeveloped nation, would have the decisive advantage of having already on hand the skills needed to rebuild and operate an advanced economy. These skills may be worth more than our material wealth. The postattack situation would be more difficult than that of an underdeveloped country because of the radiation that would hamper many postattack activities, and the fact that our people are now poorly adjusted to the low level of living that would be unavoidable under postwar conditions. Help from outside the United States, or from less heavily affected areas within it, could, however, be more effectively used here than in underdeveloped countries.

A major vulnerability of the U.S. economic system, in addition to the interdependence of its elements, is its dependence on electric power, petroleum, communications, and transport. Because of interdependence and the importance of timing, the postattack measures for restoring production must follow a sequential order. For example, first priority might be restoration of power; next for that of communications, water and sewage, fuel, and transportation.

Among the various sectors of the economy, petroleum may be the Achilles heel, in that refineries, ports, and stocks are very vulnerable targets. The situation regarding medical supplies would be

desperately bad if an attack came now, but could be improved relatively easily.

Adequate measures to meet the recovery requirements of a surviving population protected by the proposed OCD fallout-shelter program would probably cost as much as the shelter program itself. In a large civil defense program in which blast shelters were constructed in metropolitan areas, it would be reasonable to spend more on recovery measures than on the shelters themselves, though probably not twice as much. As shelter protection is extended, preparations for recovery should also be undertaken.

SUMMARY OF PROPOSALS

Some of the proposed preparations are listed below under six headings.

Recovery of the social and economic systems. As a principle, the panel warns against resorting to disaster socialism unless truly necessary, since such an action would, in the long run, delay the transition from an economy based on stockpiles to a normal one in which consumption and production are balanced. The panel believes that government interference with the spontaneous recuperative process of a free economy should be held to a minimum. Whenever it has to be invoked, it should be continued no longer than necessary. In areas where some sort of price control is needed, the panel urges that it be carried out by currency and credit control rather than by outright price determination by fiat. Nevertheless, the government must make the preparations needed for it to assume complete responsibility for economic recovery. More specific proposals follow:

1. There should be an organization that would be *able* to assume responsibility for law and order in damaged areas, manage stockpiles, and supervise the crews repairing the damage to utilities and power sources. If necessary, the organization should be able to maintain paramilitary control until the civilian rule and economy can be restored. Such an organization might be part of the civil defense cadre.

2. A Federal Asset Validation and Equalization Corporation, proposed in earlier studies, should be organized to function, principally, in less damaged areas. It would extend credits to

prevent a chain reaction of bankruptcies, and help in restoring the monetary-financial structure of the economy.

3. The Program Analyses for Resource Management, an organization also proposed in earlier studies, should be used to provide information, interregional communication, and economic guidance for both local authorities and, if desired, also for individuals.

4. When necessary, key sectors of the economy, such as power and transportation, should be placed under paramilitary control, particularly if their restoration to production and their operation would be hazardous.

The functioning of the social and economic systems under stress, and when the administrative structure is impaired, should be studied intensively and with as much depth as possible. The panel urges the establishment of a program for collecting and storing data on the demographic characteristics to be expected under varied assumptions of attack and protection. Much could be learned from a study of the functioning and of the effectiveness of the stabilization and resource-management measures established in World War II. The control of purchasing power in the civilian economy by the extension or withholding of credit can be a powerful means for preventing inflation and for channeling private incentives toward desirable objectives.

Water and food supply. The panel considers that a policy of eliminating cropland from production because of high Sr^{90} or Cs^{137} contamination would be unnecessary. Rather, there should be a food triage whereby food grown in contaminated areas is monitored and used for human consumption, for animal consumption, or its use delayed according to the needs of the people and the contamination level. Similarly, the panel believes that cows that are not seriously affected by external radiation would generally not have consumed enough radioactive material for their milk or meat to produce serious injury to the consumer. Special care must be exercised with milk for babies, however, because of the possible effect of I^{131} on their thyroids.

The panel emphatically concurs with the recommendation of the Immediate Survival Panel that

1. Current food stocks should be relocated and the availabilities made known to local and state planning authorities. Fish protein should be added to the food stockpile.

2. Stand-by power and shielding for personnel should be available in order to ensure early operation of the water and power system.

It recommends further

3. The stockpiling of fertilizers, insecticides, and of spare parts of agricultural machinery.

4. That the fuel stockpiles be planned with due regard for the needs of agriculture and the moving of food to processing and distribution centers.

5. That current research on the behavior of fallout particles produced by explosions over various terrains be continued in order to arrive at better estimates on the probable contamination of water in reservoirs during the later postattack periods — 3 to 10 years after attack. For the same purpose, regional water run-off studies should be undertaken.

In the opinion of the panel, bacteriological contamination of untreated water is likely to be more important than radiological contamination. Information on methods to eliminate both contaminations is available and has been distributed by several agencies.

The panel emphasizes the importance of the early restoration of agricultural production. New agricultural equipment may be needed from the second year on.

Ecological recovery. The investigation of ecological damage and recovery should continue, and environmental defense should become part of civil defense. As the preceding discussion indicates, there remain uncertainties concerning the intermediate and long-time ecological consequences of a nuclear war. The methods to improve our knowledge in these areas are, however, available.

Large-scale primary fires, totally destructive insect plagues, and ecological imbalances that would make normal life impossible are not to be expected. Nevertheless, in order to minimize these dangers, and to enhance recovery, it is recommended that

1. seeds be stockpiled,

2. plans be formulated for erosion control, protection of watersheds, and for reforestation, and

3. salvage lumbering of forests killed by fires or radiation be planned so that it could be undertaken within 2-3 years after the attack. Except for such salvage, it would probably require

decades after a nuclear war before a significant timber crop could be produced from severely damaged lands. The reforestation would hardly begin on a large scale before five years after a major attack.

Radiological recovery. Augmented planning and training programs and an increased research effort should be undertaken.

Medical recovery. The Postattack Recovery Panel proposes the establishment of a permanent medical organization to cope with problems arising in case of a national disaster. This organization should be able to assume command functions in case of such a disaster. Increased effort is urged in the following areas:

1. Research on secondary disaster medicine, dealing with likely patterns of human disease, rehabilitation, and animal diseases.
2. Institution of vaccination and immunization procedures that can be applied nationally.
3. Study of the biological and pharmaceutical industry and the production of medical instruments. Possible bottlenecks in the production of medical supplies should be uncovered and means found for the speedy restoration of production.
4. Organization of the medical elements within the mobile units discussed in the Immediate Survival summary.
5. Study of altered patterns of the medical care of displaced and economically distressed people.
6. Research on consequences of a possible change in available food, in particular the possibility that deficiencies may develop if certain types of food become unavailable. The problem of feeding babies during the period in which there is too much iodine activity in milk has been mentioned.

The panel recommends the construction of emergency hospitals at appropriate sites. Plans should be formulated also for the repair, reconstruction, and decontamination of hospitals, medical and paramedical schools, and of related structures.

General problems. The panel was concerned that, until the recovery problems and requirements are more thoroughly studied, present inadequacies in such areas as communications and warning and command and control are not likely to be removed. The panel urges that the OCD consider the establishment of a postattack-

operations development group to serve as a pilot-study and operations-evaluation group. Thus experience could be gained and organizational techniques created that could be used as the civil defense program expands.

An expanding program will emphasize the need for better understanding of the relationship between survival and recovery. Such knowledge would not only permit better determination of the balance of effort between these programs, but might also lead to a closer integration of programs for recovery with the normal economic and social programs of the United States.

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APPENDIX B

NATIONAL ACADEMY OF SCIENCES

OFFICE OF THE PRESIDENT
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February 14, 1964

The Honorable
Steuart L. Pittman
Assistant Secretary (Civil Defense)
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Washington, D. C. 20301

Dear Mr. Pittman:

I will shortly transmit reports, comprising nearly a thousand pages, which were prepared as a result of the six-weeks Harbor Study on the subject of civil defense and post-attack recovery conducted at Woods Hole last summer under the sponsorship of the National Academy of Sciences.

A short report summarizing some of the essential conclusions drawn by those participating in the study is enclosed herewith.

As you will appreciate, the summary and the reports should be considered to reflect the opinions of those who participated in the study and not necessarily those of the membership of the Academy or its officers.

Sincerely yours,

Frederick Seitz

Frederick Seitz
President

Enclosure

NATIONAL ACADEMY OF SCIENCES
NATIONAL RESEARCH COUNCIL
2101 CONSTITUTION AVENUE, WASHINGTON 25, D. C.

HARBOR STUDY: PRELIMINARY STATEMENT

Summary of the views of the study group convened by the National Academy of Sciences in the summer of 1963 to consider the problems of the civil defense of the United States.

During a six-week period beginning August 7, 1963, the National Academy of Sciences, under contract to the Office of Civil Defense, Department of Defense, assembled a group of approximately 60 leading scientists and engineers drawn from universities, private industry, and governmental organizations at the Academy's summer study facility at Woods Hole, Massachusetts, to examine the likely effects of enemy attacks on the United States, and the problems of civil defense of the country now and in the future. The group considered the technologies of offensive and defensive weapons systems as well as those relating to passive defense. Particular attention was directed to problems of immediate survival; long-range recovery; political and psychological impact of various possible civil defense programs; and civil defense education and public acceptance.

The study session, which was known as the Harbor Project, was under the leadership of Dr. Eugene Wigner, Professor of Physics at Princeton University. Dr. Wigner had associated with him a steering committee that included Dr. Lauriston S. Taylor, Associate Director of the National Bureau of Standards and chairman of the Academy's Advisory Committee on Civil Defense; Dr. Jack Vernon, Associate Professor of Psychology at Princeton University; John S. Coleman, Executive Secretary, Division of Physical Sciences, NAS-NRC; Richard Park, Technical Director, Advisory Committee on Civil Defense, NAS-NRC; L. Joseph Deal, Acting Chief, Civil Effects Branch, Atomic Energy Commission; and Jack C. Greene, Assistant Director for Post-Attack Research, Office of Civil Defense.

General Conclusions

It was generally concluded by the Harbor Study Group that any failures to assure both a higher degree of survival and a more rapid rate of recovery from attack by strategic weapons of today and of the foreseeable future are not a result of deficiencies or gaps in our technical knowledge. If the United States is to obtain a higher degree of survival and ability to recover from attack than is contemplated by cur-

rent defense planning, the primary needs are more money for passive defense measures, wider application of existing technical knowledge, and more intensive research in support of planning and program design.

It was the opinion of most members of the Harbor Group that the currently proposed fallout shelter program advanced by the Office of Civil Defense provides somewhere near the optimum protection that can be achieved under the proposed budget. This program was, however, considered to represent a minimum level of significant protection below which a national effort may not be justified at all. A more adequate program, which was generally favored by the participants in the study, would include (1) shelters in target areas that are capable of protecting against blast and fire, (2) stockpiling of necessary supplies and hardening of critical facilities, along with intensive planning to accelerate recovery, and (3) substantially greater federal involvement in the program in an effort to improve professional competence and coordination of operations.

It was concluded that, whether or not an increased level of civil defense effort is undertaken, the program now projected by the Department of Defense at relatively low cost could contribute significantly to increased survival under nuclear attack. Moreover, this program would provide a necessary base for any increased effort toward improvement of our defenses and our ability to recover from major attack. The present program was accepted as being based on sound technical considerations, and most of the attention of the study was therefore directed toward the opportunities and difficulties of providing further passive defense capability.

Weapons Effects

The study devoted particular attention to assessments of both known weapons effects and those effects which could be predicted by reasonable extrapolation. It also devoted attention to those measures which might be applied in order to reduce or prevent losses from exposure to radiation, blast, and thermal effects of nuclear weapons which have yields as great as 100 megatons. The effects of modern biological and chemical weapons were also considered, as were the effects of nuclear weapons of special types, such as the neutron bomb, bombs designed to produce the tsunami (wave) effect, very large high-altitude bursts, weapons "salted" to increase fallout hazards, as well as other weapons. As a result of these assessments, it was concluded that nuclear weapons of the type now in the U. S. and Soviet arsenals present the major threat to passive defense. Although yields and yield/weight ratios may be expected to increase, there is no reason to expect that the nature of weapons effects will change significantly in the foreseeable future.

Considerable attention was given to the problem of fires which result from nuclear explosions. It was concluded that, while fire would undoubtedly add significant damage to that resulting from other weapons effects in a heavy nuclear attack, most fires would occur in areas where there is heavy blast damage. Shelters designed to protect against various levels of blast would also protect against corresponding levels of radiation, both nuclear and thermal, and could readily be equipped to provide protection from fires and, at the same time, from biological and chemical weapons.

The use of very high-yield weapons detonated at very high altitude for incendiary purpose might cause major fire damage. The study group was inclined to believe, however, that an enemy would be most unlikely to devote his delivery capability largely to attacks intended to produce purely incendiary damage as an alternative to producing predictable blast damage on a carefully selected system of targets.

Recovery

The study group recognized that the technology involved in sheltering from the effects of nuclear weapons has advanced far beyond our understanding of the problems of recovery. As a result, considerable attention was devoted to identifying research requirements for this very complex subject, and to placing priorities on such work. It was concluded that if improved ability to recover from the attack within a reasonable period of time is to be achieved, intensive attention must be given to a number of unsolved problems related to postattack recovery. The study group felt that it is in this sector of planning and preparation that our national program is the most deficient.

The group believed our extremely complex economy to be particularly vulnerable because of the high degree of interdependence of its different segments. At the same time, they felt that the great size and large reserve capacity of our economy provide a potential that favors recovery if ready access to utilities such as power, transportation, and communications that are vital to its operation can be maintained or quickly restored. Recovery operations, including decontamination, would, in the group's belief, demand the availability of professional leadership, as well as plans and equipment, well beyond that which could be made available by our current program of civil defense.

Public Acceptance

It was the opinion of the study group that the public will accept civil defense programs if they are accepted by the President, the National Security Council, the Joint Chiefs of Staff, and the Congress as an integral part of our over-all defense program. It was felt that the attitudes of the general public would be greatly conditioned by the demonstrated convictions of public leadership.

It was also the opinion of the study group that the features of any

civil defense program most likely to receive public acceptance are the following:

1. A clear link between civil defense and the total defense of the nation.
2. Full federal responsibility for the program.
3. Civilian leadership, with the armed forces available to provide special forms of support.
4. Maximum use of existing resources and professional organizations which are capable of aiding public safety.
5. Long-term planning, as distinct from crash programs.
6. Moderate budgets that are related in a reasonable way to over-all expenditures for defense, rather than budgets which may appear to be inadequate and incomplete. Massive and hurried programs probably will not be acceptable to the public unless international relations deteriorate severely.
7. Equitable distribution of protection for all citizens.

Impact of Civil Defense Programs

The study group made a careful effort to assess the implications that an effective civil defense program might have on our own national security objectives, as well as on the strategies of other nations. It was the opinion of those members of the group who studied this problem that although a sudden, large-scale effort might well disturb our relationships with other nations, an orderly and well-designed program having the primary purpose of providing reasonable assurance that our nation is able to survive severe damage and substantial loss of lives, or is in a position to reject ultimata, would be welcomed by our allies and would be respected by those who might contemplate aggressive action. Furthermore, it was the opinion of the group that assurance that we possess reasonable protection from sudden and unprovoked attacks would provide a more favorable climate for the adoption of significant disarmament measures on an international basis.

The group also concluded that programs incorporating the characteristics described above, which they believe are acceptable to the public, would have no more than a minimum detrimental effect on domestic and international issues of a psychological, social, or economic nature. It is of course impossible to prove that no harmful effects would accrue from any program as large and penetrating as one in civil defense might become. The study group could find no evidence, however, to demonstrate that civil defense programs of the type described would change the nature of our society in a radical way.